

WHAT IS CLAIMED IS:

1. An intercooler for cooling intake gas for an internal combustion engine having an intake manifold, wherein the intake manifold supplies intake gas to at least one engine cylinder, comprising:

a body having a longitudinal axis, and a passageway formed in the body; and

an inlet opening located on one end of the body, wherein the intake gas enters the passageway through the inlet opening; and

a plurality of cooling tubes forming at least a portion of the body, wherein the plurality of tubes at least partly surround the passageway, wherein each of the plurality of cooling tubes is spaced from an adjacent cooling tube such that an air flow path is formed there between. [I think elongated is not an essential feature of the intercooler body, therefore I propose to not consider it in Claim 1 → Please assure that we have this feature in the specification, just for the case when we would need it during prosecution]

2. The intercooler according to claim 1, wherein the passageway is a central passageway that extends substantially parallel to the longitudinal axis.

3. The intercooler according to claim 1, wherein the plurality of tubes substantially surround the passageway.

4. The intercooler according to claim 1, the intake gas flows along the passageway within the body and radially outward therefrom through the air flow path between the cooling tubes.

5. The intercooler according to claim 1, wherein the plurality of cooling tubes extend substantially parallel to the longitudinal axis.

6. The intercooler according to claim 1, wherein the plurality of cooling tubes comprise:
a first group of cooling tubes operatively connected to a coolant inlet; and
a second group of cooling tubes operatively connected to a coolant outlet, wherein the first group of cooling tubes is operatively connected to the second group of cooling tubes such that a coolant flows from the coolant inlet into the first group of cooling tubes, the coolant flows through the first group of cooling tubes to the second group of cooling, the coolant then exits the second group of cooling tubes through the coolant outlet.
7. The intercooler according to claim 6, further comprising:
an outlet ring connected to one end of the body, wherein the outlet ring operatively connects the first group of cooling tubes to the second group of cooling tubes such that the coolant flows from the first group of cooling tubes to the second group of cooling tubes.
8. The intercooler according to claim 7, wherein the outlet ring is located on an end of the body opposite the inlet opening.
9. The intercooler according to claim 6, further comprising:
an inlet ring connected to one end of the body, wherein the inlet ring includes the coolant inlet and the coolant outlet.
10. The intercooler according to claim 1, further comprising:
at least one plate extending substantially orthogonal to the longitudinal axis, wherein each of the at least one plate includes a central opening therein, wherein the central opening corresponds to the central passageway in the body such that the intake gas is capable of flowing through the central opening.
11. The intercooler according to claim 10, wherein each plate comprising:

a plurality of openings formed thereon about a periphery of the plate, wherein one of the plurality of cooling tubes is received within a corresponding one of the plurality of openings.

12. The intercooler according to claim 10, wherein the at least one plate includes a plurality of plates spaced along the longitudinal axis of the body.

13. The intercooler according to claim 1, further comprising:

a wire gauze extending the length of the body, wherein the wire gauze being positioned between the central passageway and the plurality of cooling tubes.

14. The intercooler according to claim 1, further comprising:

at least one plate extending substantially orthogonal to the longitudinal axis, wherein each of the at least one plate includes a plurality of openings formed therein for receiving one of the plurality of cooling tubes.

15. The intercooler according to claim 14, wherein the at least one plate includes a plurality of plates spaced along the longitudinal axis of the body.

16. The intercooler according to claim 1, further comprising:

a flow director surface for directing the intake gas into the passageway.

17. In an internal combustion engine having an intake manifold supplying intake gas to the intake port of at least one engine cylinder, an intercooler for cooling the intake gas before the intake gas is supplied to the at least one engine cylinder, comprising:

an body having a longitudinal axis; and

a plurality of cooling tubes being supplied with a coolant, wherein each of the plurality of cooling tubes is spaced from an adjacent cooling tube such that an air flow path is formed

there between such that the intake gas flows through at least one of the air flow paths before flowing into the intake port of the at least one engine cylinder,

wherein the intercooler being positioned at least partly within the intake manifold.

18. The intercooler according to claim 17, further comprising:

a passageway that extends substantially parallel to the longitudinal axis.

19. The intercooler according to claim 18, wherein the plurality of tubes substantially surround the passageway.

20. The intercooler according to claim 18, wherein the internal combustion engine comprises at least two engine cylinders, wherein the intake manifold includes at least two intake pipes, which correspond to the at least two engine cylinders, wherein the intercooler is arranged within the intake manifold such that the intake gas flows into the passageway, wherein the intake gas flows radially outward away from the passageway through the air flow paths past the plurality of cooling tubes into the respective intake pipe.

21. The intercooler according to claim 20, wherein the plurality of cooling tubes comprise:

a first group of cooling tubes operatively connected to a coolant inlet; and

a second group of cooling tubes operatively connected to a coolant outlet, wherein the first group of cooling tubes is operatively connected to the second group of cooling tubes such that a coolant flows from the coolant inlet into the first group of cooling tubes, the coolant flows through the first group of cooling tubes to the second group of cooling, the coolant then exits the second group of cooling tubes through the coolant outlet.

22. The intercooler according to claim 21, further comprising:

an outlet ring connected to one end of the body, wherein the outlet ring operatively connects the first group of cooling tubes to the second group of cooling tubes such that the coolant flows from the first group of cooling tubes to the second group of cooling tubes.

23. The intercooler according to claim 21, further comprising:

an inlet ring connected to one end of the body, wherein the inlet ring includes the coolant inlet and the coolant outlet.

24. The intercooler according to claim 19, further comprising:

at least one plate positioned within the body.

25. The intercooler according to claim 24, wherein each of the at least one plate includes a plurality of openings formed therein for receiving one of the plurality of cooling tubes.

26. The intercooler according to claim 24, wherein the at least one plate includes a plurality of plates spaced along the longitudinal axis of the body.

27. The intercooler according to claim 25, further comprising:

wherein each of the at least one plate includes a central opening therein, wherein the central opening corresponds to a passageway in the body such that the intake gas is capable of flowing through the central opening through the passageway.

28. The intercooler according to claim 27, further comprising:

a flow director surface for directing the intake gas into the passageway.

29. An intake manifold in combination with an intercooler, wherein the combination comprising:

an intake manifold having at least one intake pipe for supplying intake gas to at least one engine cylinder and a passageway positioned within the intake manifold for supplying intake gas to each of the at least one intake pipe; and

an intercooler at least partially positioned within the passageway, wherein the intercooler has a body having a plurality of cooling tubes located therein, wherein each of the plurality of cooling tubes is spaced from an adjacent cooling tube such that an air flow path is formed there between such that the intake gas flows through at least one of the air flow paths before flowing into the at least one intake pipe.

30. The combination according to claim 29, wherein the intercooler further comprising:

at least one plate positioned within the body, wherein each of the at least one plate includes a plurality of openings formed therein for receiving one of the plurality of cooling tubes.